OVERCOMING RESISTANCE TO FULL UTILIZATION OF COMPUTER & INSTRUCTIONAL TELEVISION TECHNOLOGY: A BEHAVIORAL APPROACH*

by
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The broad scope and accelerated pace of the information explosion in modern industrial and educational facilities demand the application of advanced communication devices to solve some of the pressing problems being created. Management as well as schools, colleges, and universities are concerned about how to control and sift relevant information from the vast amount of data being generated. Through intelligent use of the newer communication tools, the requisite controls can be established. However, optimum, efficient, and effective utilization demand the evolution of a technology—a scientific method of implementation.

Problems of implementation, not hardware, are the stumbling blocks preventing the development of true technologies. The purpose of this paper is to review the history of two advanced communication devices—the computer and television—to describe the nature of resistances preventing technological development, and to suggest an approach for overcoming some of the resistances.

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THE COMPUTERS UNREALIZED POTENTIAL

John Diebold (6), a pioneer in the field of automatic data processing and computer technology, has written about the unrealized potential of the computer. In a recent issue of the Harvard Business Review, he describes five distinct phases of evolution since the computer made its appearance 19 years ago:

1. In the early 1950's, potential users were extremely cold to the concept of computer use—everyone had to be shown.
2. During 1956 and 1957, the computer served as a status symbol to management. Fantastic claims of savings were projected, and "showcase" installations were described in great detail in corporate annual reports.
3. Disillusionment came with the onset of the 1957 recession, and it was quickly associated with the "failure" of computers to live up to the expectations imposed on them.
4. Diebold describes the fourth era, the early 1960's, as one of growing sophistication on the part of users regarding the obvious data-processing applications. Of importance, too, was the growing appreciation by computer manufacturers of the kinds of management problems that should be considered in computer design.
5. The order existing today, Diebold contends, is one of routine acceptance of the computer as an everyday tool of business. This is evidenced by the fact that approximately 15,000 computer systems are now installed in this country alone and that more are on order than were built in the past 15 years.

But the significant question posed by Diebold is "where are the computers located, and what services are they performing?" He reports that the use of the computer in most companies is characterized by a lack of imagination and inspiration. Little more is being done than adding speed and economy to tasks performed with earlier equipment, systems, and procedures. He deplores that most installations are lodged amid a jungle of punched-card peripheral gear and that computer responsibility is generally assigned to the assistant controller in charge of machine accounting.

To combat this improper implementation, Diebold suggests first that top management must be made aware of the problem. This would be accomplished by education of managers in the potential of information systems, and by a concerted effort devoted to business management research. Creation of a place in the organizational structure for a technology of business information systems would be paramount.

The steps proposed by Diebold for overcoming the lag in computer technology implementation certainly have merit. But to carry out his recommendations, the critical hurdle of middle-management structure of organizations must be overcome. It is here that strong resistances to information technology are so prevalent. Until recently, resistances to the computer have been relatively mild. The elimination of the time-honored bookkeeping functions have not directly affected the role of middle management. Rarely has there been any threat of the elimination of the tasks now performed by this section of management. But Burck (1), in describing the computer's usefulness to top management, states that many functions

of middle management must be delegated to the computer as a condition to its full utilization. He discusses how computers can organize and process information so rapidly that top management can know everything important that happens as soon as it happens. Subordinate judgments can be eliminated. Through advanced simulation techniques, hundreds of hypothetical situations relative to decision making can be analyzed by the computer for choosing the best course of action. Decisions relative to purchasing, planning, marketing, performance, scheduling, and manufacturing can all be made by top management by-passing the middle management structure of judgment and intuition. Burck envisions the structuring of centralized control for long-range strategies through top management's use of the computer and the delegation of short-range activities to a decentralized middle management. Burck describes several case histories where this is currently occurring but points out that the resistances by middle management are indeed strong. He feels somewhat pessimistic about the problem and suggests there may be many impasses before solutions.

It is suggested that this resistance can be neutralized in part by having middle management participate in educational programs, as Diebold recommends for top management. But perhaps more vital would be for middle management to become involved, along with top management, in study efforts designed to develop a technology of computer utilization. Middle management would be assured that their structure is vital, but they would be informed that their responsibilities may shift. Study efforts will evolve the logistics of shift and determine what functions could be most effectively

handled by the computer. Later on in this paper, an outline of a typical study effort related to instructional television is presented. Most of these elements are equally applicable for computer utilization study.

INSTRUCTIONAL TELEVISION'S UNREALIZED POTENTIAL

Instructional television appears to be following a path of utilization-evolution parallel to that of the computer. The nature of resistance to optimum use of the medium and the problems related to the development of a technology seem almost identical to those associated with the computer. Instructional television, however, is much farther behind in its evolution. For example, the use of television as an industrial management tool to provide management with real-time visibility of conditions and problems or to control training requirements has not occurred. Ironically, not even the manufacturers of television hardware are using their own creations, in spite of many apparent potential applications. Thus, it would appear that television is in phase one, the "show me" phase, as related to industrial applications for management communications and training. However, two exceptions should be noted: (1) the utilization of closed circuit television at the South Carolina Educational Television Center to upgrade and train industrial workers and professional groups throughout the state, and (2) the application of closed circuit television as a management and training tool at North American Aviation. These installations are described in the August 29, 1964, issue of Business Week.

It should be pointed out that some exceptions also exist in the military. Kanner (11) has reported on many closed circuit systems utilized in the

Army's service schools. Yet there are reports on overemphasis of hardware, capital investments in equipment unresponsive to requirements and underemphasis on systems responsive to objectives. It would appear that the military is in phase two, analogous to Diebold's "status" phase for the computer. The phase evolution in schools and colleges would appear, on the surface, to be of a much higher order. But a closer look indicates this is not the condition.

A report from the Ford Foundation (8) estimates that in 1961, 7500 elementary and secondary schools were offering some instruction by television and at least 117 colleges were instructing through the medium. This estimate did not include open circuit commercial stations or closed circuit installations. And yet, the National Association of Educational Broadcasters has estimated that not more than one or two percent of students get a significant part of their education from television. The report continues in noting that while up to four percent of the schools and two percent of the college students may have some television experience, instructional television is usually confined to only one course so that less than one percent of the whole educational experience involves television.

Resistance to instructional television at the university and post-graduate, professional level has been reported by many investigators. Mara (12), in a recent talk before a computer training panel, discussed the nature of resistance to television by university faculty members in general and by computer science instructors specifically. He suggested that faculty members traditionally view their own departmental research with much greater

respect than instructional technology research. Thus, instructors are hesitant to find time for exploring new methods. Mara contends that in a field as new as computer science this condition appears particularly true.

Romano (13), as a result of an intensive study of television utilization in dental education, has arrived at a similar explanation relative to the utilization of television in dental schools. There are 48 dental schools in the United States. Of these, 30 have television hardware, but not one reports any major change in teaching techniques that have occurred as a result of the medium. Application is generally restricted to image magnification. Romano discovered only isolated efforts being applied to make optimum utilization of television. He noted a great deal of indifference, apathy, and resistance toward its use.

Clark Trow (14), in his book Teacher and Technology: New Designs for Learning, argues that many changes will need to be made in educational facilities, in organization and management of schools, and in the roles of teachers and students to effectively and efficiently introduce newer technologies into education. Trow states that the making of these changes constitute the main barriers to their introduction but that change is the order of the day. He is optimistic about the pace with which change will occur. If Trow were discussing the inroads that computers are making in education, perhaps his optimism would be justified because computer familarization and utilization causes have become prerequisite for advanced study and research. Instructional television, however, has not reached this level.

C. R. Carpenter (3), in reviewing Trow's book, expresses concern over this condition. He points out discouraging field tests in schools relative to the use of programmed instructional techniques and the lack of concerted efforts devoted to the use of programmed instruction in television for improving instruction for large groups. Certainly Carpenter's skepticism is justified in light of the over-all limited use of instructional television and the limited, narrow approaches taken in reference to programmed instruction. Brown and Thornton's book (2) on New Media in Higher Education points out some exciting exceptions. For example, the Florida Atlantic University, Boca Raton, which was planned and designed around a systems approach to the use of instructional media and technology. The authors report an intensive cross section of practices and research in the use of newer instructional media in approximately 50 collegiate institutions in this country. Of particular significance, which the authors note, is the systems approach to education within those institutions who are beginning to realize the full potential of instructional technology.

It is posited that a systems approach is paramount in the development of a technology. A major purpose of this paper is to clarify the meaning of such an approach and to suggest it as a first step in overcoming resistance to technology.

THE SYSTEMS APPROACH—A BEHAVIORAL TASK

There has been a great deal written about the importance of systems approach in technology. Finn (7), Carpenter (4), and others have related it to education. But the requisite steps have not been systematically defined.

In this paper, an attempt will be made to outline some of the tasks that are required in a systems approach for implementing instructional television as a technology and to describe some behavioral principles that should be generalizable to the development of other technologies. In industry, Frankel (9) has described an over-all systems study effort at North American Aviation prior to the installation of closed circuit television, and the author (5) has reported on specific phases of systems implementation at that company.

The objective of a systems behavioral approach is to develop a technology. Trow's (14), definition of technology, "any practical art using scientific knowledge," is posited as being appropriate. It should be noted that the term "practical art" is used but is qualified by scientific knowledge. An analogy from the practice of medicine clarifies the meaning. Medical practice is an art; but without the scientific knowledge that must accompany the practice, it is not a technology.

In the case of instructional television, the criteria for a technology are the same—the development of practical art using scientific knowledge. This implies a scientific approach in several specific phases relative to the implementation of a true technology. For television, the initial concern is a determination of the potential value of a system in comparison with costs. This determination constitutes a study—the task of a research team to investigate the organization's communication and training requirements with emphasis on the identification of current and anticipated problem areas.

Also involved is an analysis of the suitability or adaptability of the medium in solving the problems and estimates of the cost effectiveness of a proposed, implemented technology.

The advantages of such a study must be pointed out to top management, and the authority to proceed must be authorized only at this managerial level. Prior to instituting any phase of study, top management must define its own goals and objectives for it may be discovered that implementation of the technology would be in conflict with the real objectives of management. Once the study is underway, it is vitally important that management be informed of the progress at critical points. Typical subtasks of the study would include the following:

1. Communication or instructional profiles. For all communication or instructional tasks, the objectives should be defined in terminal behaviors, that is, the behavior the student or management is expected to demonstrate as a result of the particular instruction or communique. The behaviors should be further analyzed by the type of learning that is required for the accomplishment of the objectives.

2. Analysis of the characteristics of each lesson or communique presented. Data should be collected on the number of personnel currently involved in the communication-training tasks; frequencies of revisions; provisions for review, audience response, and examinations; and the nature of the stimulus materials employed.

3. Adaptability of subject materials to the medium. The developed profiles and subject characteristics must be systematically compared with the attributes of the medium being considered. Those subjects characterized by stimuli that can be controlled more effectively by other methods will be eliminated as "candidates" for further analysis.
4. Application of economic criteria. This subtask involves the development of standard units of costs for conventional methods employed and for proposed methods. In those instances where the proposed method is higher in costs than the conventional, other factors will have to be weighed prior to final decisions. Such decisions should be made jointly by the research team and top management.
5. Construction of models. Diagrams that depict optimum, efficient utilization of the medium should be prepared. These diagrams should be discussed and reviewed with top management. Included in the description of the models would be staffing and equipment requirements, distribution channels, programming development guides, production considerations, and recommendations for the control and management of the technology.

Obviously, the execution of such a study necessitates an interdisciplinary approach: personnel skilled in interviewing techniques with proven ability to ferret out problem areas and define objectives in behavioral terms,

personnel knowledgeable in the medium being considered including its full range of capabilities and limitations, and personnel with the requisite cost accounting experience to compare relative cost units of conventional methods with those proposed.

It is often difficult to convince top management or school administrations to allocate funds for conducting such a study. In some instances, it may be fear of visibility or a desire "not to rock the boat." But too often, members of management have been "sold" on what they perceived as research, but what was, in actuality, something else. For example, the "self-made expert" on television who oversimplifies it by contending: "anyone can operate this particular system." The result is that management provides no budget for operation, maintenance, or staffing.

Effective television utilization means more than the mere distribution of an image from one place to another, just as effective computer use means more than arithmetic functions processed at fast speed. Both devices require specialized skills for effective utilization, and without these skills the results will be marginal or even negative. Thus, the integrity and proven experience of a research team and the potential gains from a well designed study must be presented in a logical, well-conceived plan of action to top management. Often, several phases can be introduced for consideration with an evaluation made jointly with management at critical points.

Following the study, the first step toward implementing a technology, a system is then installed. Implementation tasks now become continuous. For example, most television programming personnel have been trained in

the commercial broadcasting field where the programming format is passive. Instructional television should be made active. The recent work of Gropper (10) at the American Institute for Research illustrates some of the ways in which students can actively respond to televised visual stimuli. In the instruction film, Learning from Visuals: The Application of Programming Principles to Visual Presentations, Gropper shows how visuals can function as cues, reinforcement, or serve as relevant examples of principles being introduced. Such techniques should be introduced and taught to the programming television personnel who are unfamiliar with instructional methods.

Another important implementation task is the indoctrination and education of the "requester" for media service. Often, the requesters, including teachers, are naive as to their real objectives and naive concerning the potential of the media and the media limitations. Confidence in the media can be developed only through the confidence, patience, and guidance of those who are responsible for the media service. Also, the problem of evaluation is continuous. When a program has been developed and the requester previews the final product, too often he is asked, "How did you like it?" The response is usually: "I like it" or "I didn't like it" or perhaps "It was interesting, but too dramatic." Such subjective views are intolerable in a technology. The only way to evaluate an instructional program is to present it to a representative sample drawn from the population for which the instruction is intended, and test the subjects through criterion measures developed in the course of defining terminal behaviors. When deficiencies

are indicated, then program revisions should be made. With the advent of low-cost videotape machines, the costs for try-outs and revisions of televised programs have been significantly reduced.

Another task involves overcoming the fear of technology. There are large groups of individuals who abhor machines and technological advances. There is also fear associated with the stigma of error. Television, as well as the computer, represent threats to man's ego. To neutralize these fears, long-range efforts are called for—education and the development of confidence through pleasant or rewarding experience in using these tools.

In conclusion, a challenge to those psychologists in educational and industrial institutions is presented. The psychologist, just as the computer scientist, has traditionally viewed his own departmental research with greater respect than communication-instructional technology. Active participation on the part of psychologists is deemed vital in the development of a true technology because the psychologist has much to offer in shaping "practical art" through scientific knowledge into a true science. And a final quote, from Frankel (9):

"Television must serve as a tool. It must earn its place in the industrial and educational environment by observing dicisplines and controls by insisting on technical accuracy and stringent observance of deadlines, and by maintaining a program character consistent with the requester's central goal and effort. These are the responsibilities instructional television must assume if it is to burn away the glamour and the glitter that has heretofore blurred its real role."

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